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MINERAL RESOURCES AND MINERAL INDUSTRIES OF THE NORTHWESTERN ILLINOIS REGION

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ABSTRACT

The mineral resources, primary mineral producing operations, and mineral processing facilities in the Northwestern Illinois Region are located and described in this report. The region includes the 10 counties of the extreme northwestern corner of Illinois—Boone, Carroll, DeKalb, Jo Daviess, Lee, Ogle, Rock Island, Stephenson, Whiteside, and Winnebago.

Value of the area's mineral production in 1966 was $21.1 million. The mineral products included cement, crushed and broken stone, sand and gravel, natural bonded molding sand, zinc, lead, and silica sand. Other mineral materials occurring in the region include oil shale and feldspar-bearing sand.

Processing facilities in the region include an iron and steel plant, a zinc-lead flotation mill, two peat processors, one cement plant, and one plant that processes crude perlite and vermiculite.

INTRODUCTION

This report is the seventh in a series of eight dealing with Illinois mineral resources and related mineral industries. The series is prepared by the Mineral Economics Group, with the assistance of staff members in other sections of the Illinois State Geological Survey. This report covers the Northwestern Illinois Region, which comprises 10 counties: Boone, Carroll, DeKalb, Jo Daviess, Lee, Ogle, Rock Island, Stephenson, Whiteside, and Winnebago (fig. 1).

The relative importance of this region as a producer of mineral commodities for the years 1956 through 1966 is shown in figure 2. During that period, the Northwestern Illinois Region accounted for, on the average, 18 percent of the state's sand production, 11 percent of its gravel production, and 9 percent of its stone production. The Northwestern

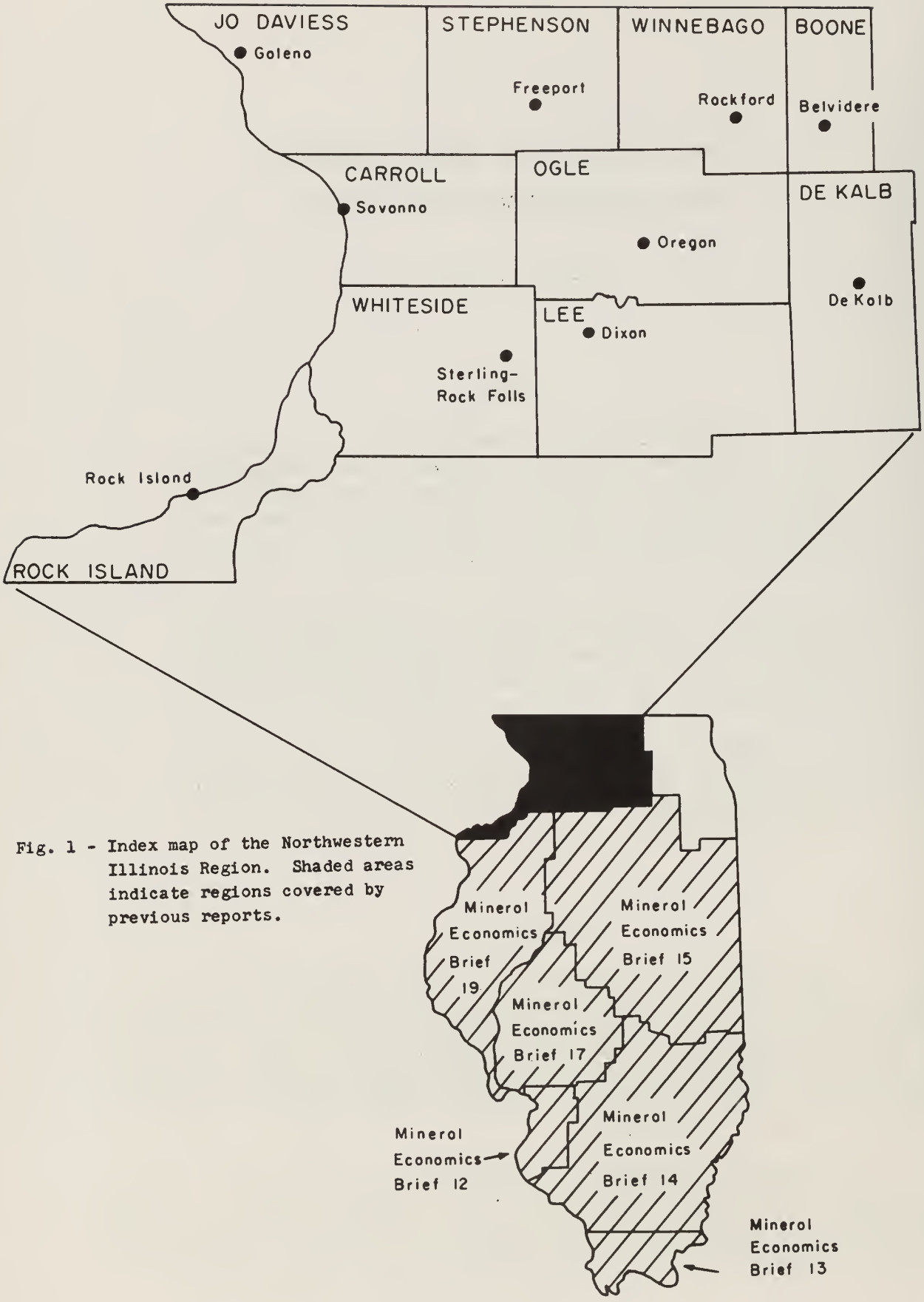

Fig. 1 - Index map of the Northwestern Illinois Region. Shaded areas indicate regions covered by previous reports.

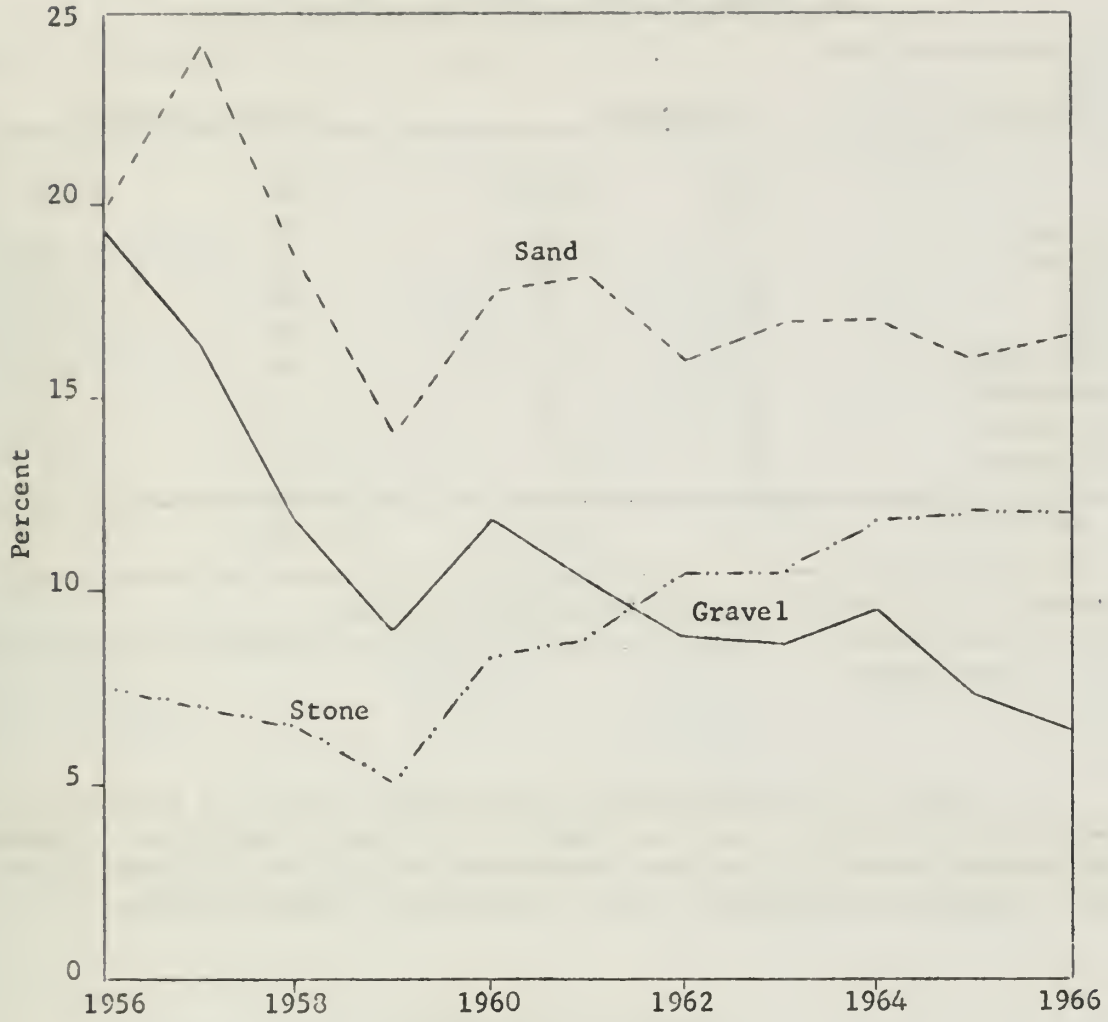

Fig. 2 - Mineral production in the Northwestern Illinois Region as a percentage of the total Illinois production for that commodity, 1956 to 1966.

Region also produced cement, natural bonded molding sand, silica sand, zinc, lead, and clay products, but information on these items is not available because there are so few producers that disclosure would reveal the confidential data of individual producers. The size of the payroll and the number of employees dependent upon the mineral industries in eight of the ten counties in the Northwestern Illinois Region are shown in table 1.

The value of mineral production for the region (table 2) was $20.3 million in 1965 and $21.1 million in 1966, or 3.3 percent of the state total for each of those years. The commodities produced, in order of their 1966 value, were cement, crushed and broken stone, sand, gravel, silica sand, lead and zinc, and natural bonded molding sand.

TABLE 1 - EMPLOYMENT AND PAYROLL OF THE MINERAL INDUSTRIES IN EIGHT COUNTIES OF THE NORTHWESTERN ILLINOIS REGION*

County	Employees		Payroll (in $1000)	
	1958	1963	1958	1963
Boone	7	NA	37	NA
Carroll	21	NA	71	NA
Lee	28	48	105	220
Ogle	89	95	381	539
Rock Island	80	84	386	591
Stephenson	12	NA	33	NA
Whiteside	21	NA	90	NA
Winnebago	222	127	1,039	673
State total	27,482	22,675	$144,359	$138,394

*Source: U. S. Census of Mineral Industries, 1961, 1966.
NA - Data not available. However, mineral production did occur in all counties during both years.

Each of the commodities is discussed in terms of resources, past and present production, and the extent of producing facilities. Undeveloped mineral resources are also considered, as well as the mineral and metal processing facilities of the Northwestern Illinois Region.

LIMESTONE AND DOLOMITE

In Illinois the principal products of the stone industry are crushed and broken stone for road surfacing, for agricultural limestone, and for aggregate used in concrete and bituminous roads and in concrete structures. The Northwestern Illinois Region possesses extensive exposures of dolomite of Silurian and Ordovician age (fig. 3). Willman (1943) and Bradbury (1965) discussed these resources in some detail. The high-purity limestones of Devonian age that are quarried near Moline were discussed by Lamar (1966). In southern Rock Island County, Pennsylvanian and Mississippian limestones crop out but are not used commercially.

In addition to the large tonnages of crushed and broken stone produced for aggregates, the region also produces limestone for use in the manufacture of portland and masonry cement. Limestone of Ordovician age is exploited in Lee County as raw material for a cement plant located at Dixon. However, cement rock production data are not included in the totals reported for crushed and broken stone. The cement operation will be discussed more fully in a later section of this report.

TABLE 2 - MINERAL PRODUCTION IN 1965 AND 1966
FOR THE NORTHWESTERN ILLINOIS REGION

Commodity	Quantity	Value	No. of operations	Average value per ton
		1965		
Limestone, dolomite crushed and broken (tons)	5,229,815	$ 5,709,775	109	$1.09
Sand (tons)	2,154,000	1,749,000	23	0.81
Gravel (tons)	1,357,000	1,247,000	32	0.92
Other materials*	----	11,640,992	---	----
	Total value	$20,346,767		
		1966		
Limestone, crushed and broken (tons)	5,176,528	$ 6,010,849	106	$1.16
Sand (tons)	2,398,000	1,923,000	25	0.80
Gravel (tons)	1,244,000	1,291,000	35	1.04
Other materials*	----	11,876,837	---	----
	Total value	$21,101,686		

*Includes cement, lead, zinc, silica sand, and natural bonded molding sand.

Regional production and value of crushed and broken stone from 1956 to 1966 are shown in figure 4. In 1966, 106 quarries, operating in the 10 counties of the region, reported a combined production of 5.2 million tons, or 12.2 percent of the state's total stone production. The three counties leading in crushed and broken stone production, in order of 1966 tonnage, were Rock Island, Lee, and Winnebago.

SAND AND GRAVEL

Sand and gravel deposits are important natural resources that occur in many places in Illinois. They are, with the exception of a few deposits located in extreme southern and western Illinois, related directly or indirectly to past glacial activity. The Illinoian and Wisconsinan glaciations produced the most important economic sand and gravel deposits in the state. An explanation of the origin of these deposits was prepared by Lamar and Willman (1958). Figure 5 shows the general location of known sand and gravel resources in the Northwestern Illinois Region.

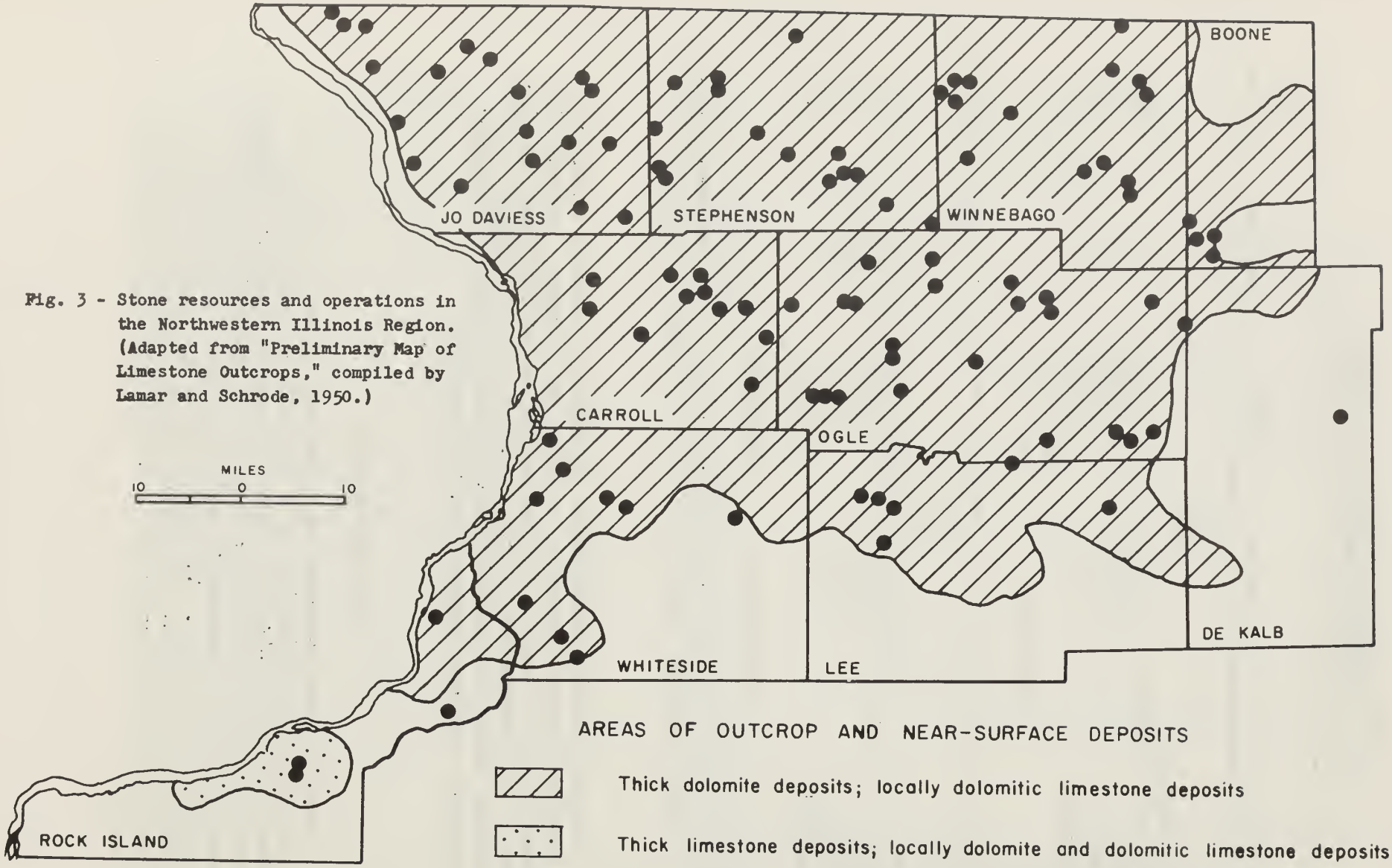

Fig. 3 - Stone resources and operations in the Northwestern Illinois Region. (Adapted from "Preliminary Map of Limestone Outcrops," compiled by Lamar and Schrode, 1950.)

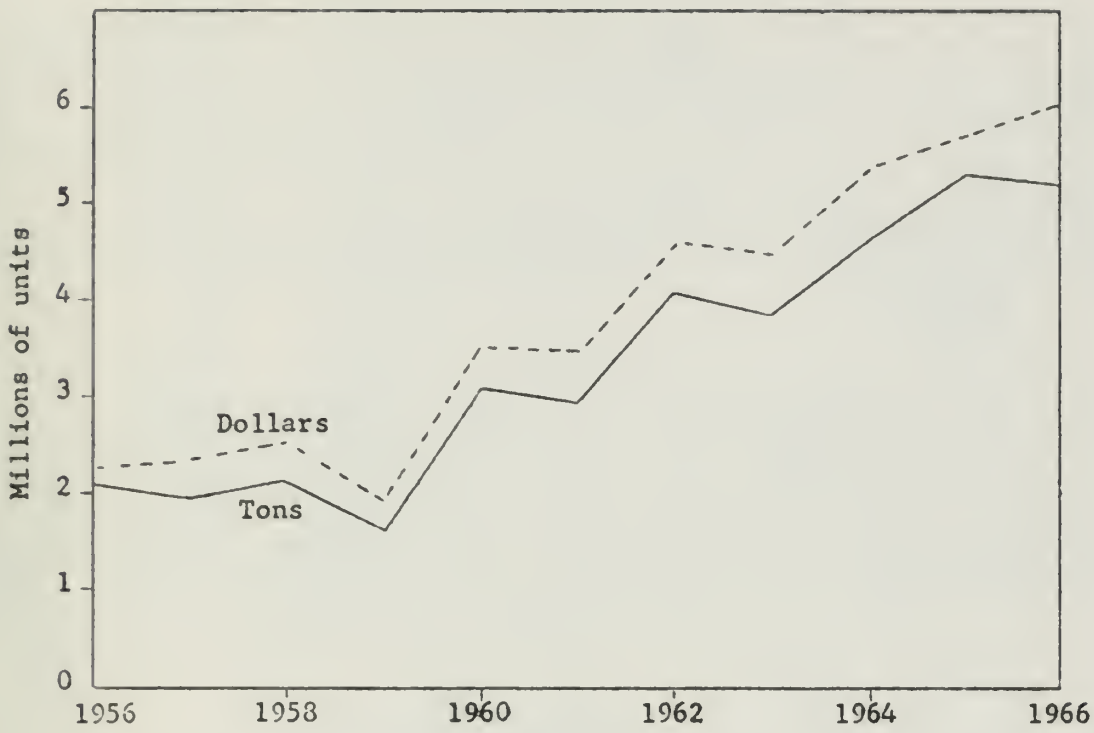

Fig. 4 - Production and value of crushed and broken stone in the Northwestern Illinois Region, 1956 to 1966.

It is not possible to give any meaningful data on reserves. As sand and gravel are low-value commodities, the market area in which a given deposit can be competitive is usually sharply restricted. Transportation costs often represent a greater portion of the delivered price than the initial value at the pit site. Because of this, a deposit usually must be quite close to the market area to be economic. For example, a study of nationwide transportation patterns has shown that rail hauls for aggregates average 80 to 90 miles; water hauls average 30 to 35 miles; and truck hauls, accounting for about 80 percent of sand and gravel transport, probably average well under 30 miles (Davidson, 1965, p. 1). However, these figures average out widely varying local conditions. Detailed reports with maps on the sand and gravel resources of Boone County (Hunter and Kempton, 1967), DeKalb County (Anderson, 1964), and the area adjacent to the Rock River (Anderson, 1967) have been published by the Survey. In addition, unpublished reports and maps for other counties are on open file at the offices of the Illinois State Geological Survey and copies of them may be purchased.

Production and value of sand produced in the Northwestern Illinois Region between 1956 and 1966 are shown in figure 6. In 1966, the 10 counties had 25 operating pits, which produced a combined total of 2.40 million tons of common sand, or 17 percent of the state total for that year. The leading sand-producing counties in 1966 were, in order of output, Winnebago, Rock Island, and Lee.

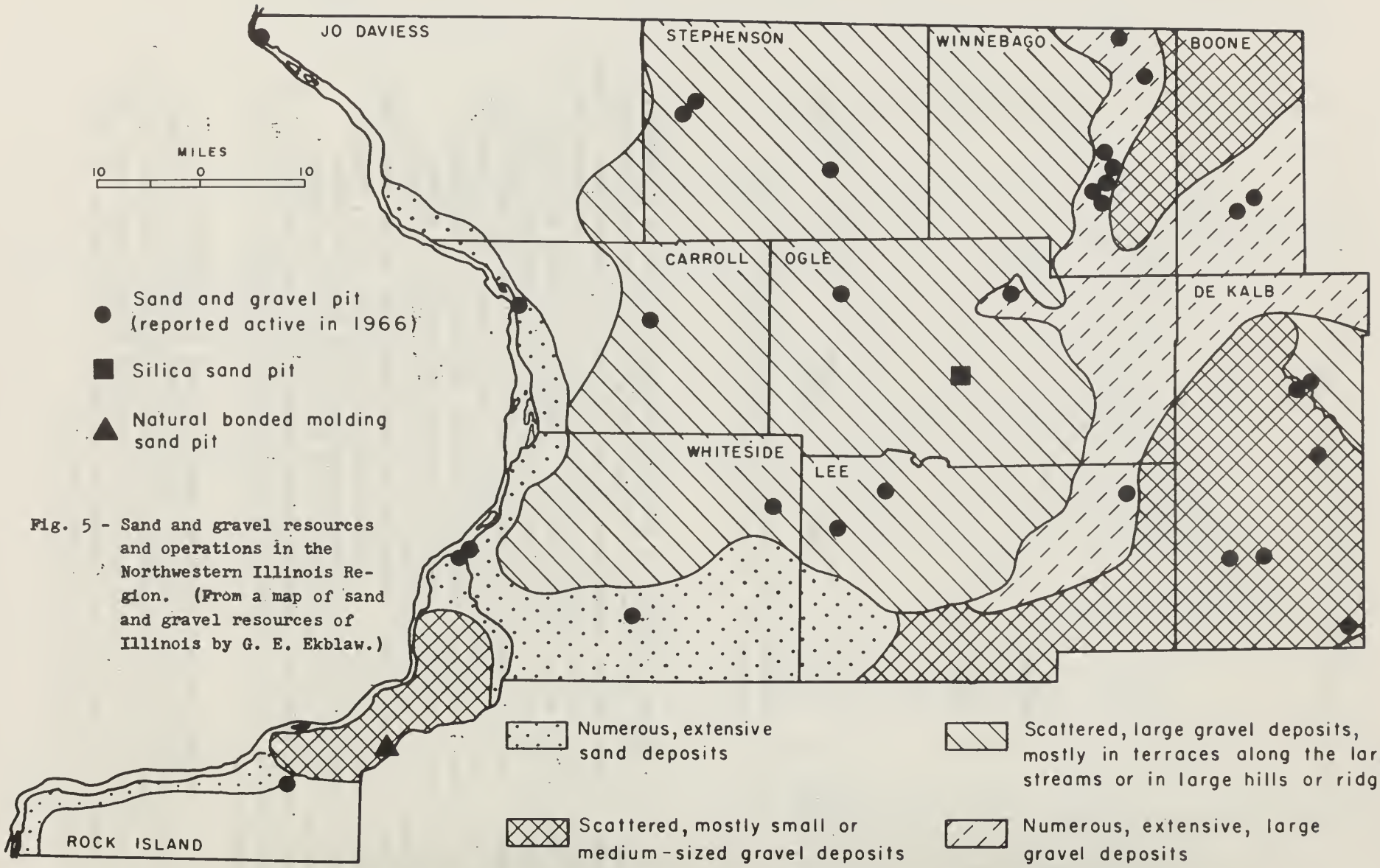

Fig. 5 - Sand and gravel resources and operations in the Northwestern Illinois Region. (From a map of sand and gravel resources of Illinois by G. E. Ekblaw.)

Production and value of gravel produced in the Northwestern Illinois Region between 1956 and 1966 are shown in figure 7. In 1966, the 35 pits operating in the region produced a combined total of 1.24 million tons of common gravel, or about 6.5 percent of the state total for that year. The leading gravel-producing counties in 1966 were, in order of output, Winnebago, DeKalb, and Lee.

In addition to common sand and gravel, small amounts of natural bonded molding sand are produced from a pit in Rock Island County at Moline.

Silica Sand

Illinois is a major producer of high-purity silica sand. Although most of the production comes from LaSalle County, smaller tonnages are produced in the Northwestern Illinois Region. The source material is the St. Peter Sandstone, which crops out in the Oregon-Dixon area in Ogle and Lee Counties. The geology of these deposits has been described by Lamar (1927). At the present time one company produces silica sand from a pit 2 miles southwest of the town of Oregon in Ogle County (fig. 5).

LEAD AND ZINC

The lead and zinc mining district of northwestern Illinois is part of the so-called "Upper Mississippi Valley District," which includes portions of Wisconsin, Iowa, and Illinois. The Illinois portion is composed mainly of Jo Daviess County, together with parts of Carroll and Stephenson Counties (fig. 8).

The first exploitation of the lead deposits in the area was carried out by the Indians prior to the first appearance of Europeans. During the 1700's the Indians traded lead with French traders and trappers for other supplies. After a period of sporadic mining in the general area by various Frenchmen and Englishmen, systematic mining on a relatively large scale was begun in 1823 by Colonel James Johnson (Trowbridge, Shaw, and Schockel, 1916, p. 184). In the following years lead production from the Upper Mississippi Valley District rose rapidly, reaching a peak of 54.5 million pounds in 1845. This amount was 85 to 90 percent of all the lead produced in the United States during that year. As the more easily found and richer deposits were depleted, Illinois production declined sharply. By 1870 practically no mines were being operated to mine ores primarily for their lead content; most of the lead since then has been produced as a by-product of zinc mining operations.

Although the presence of zinc ore in the region was reported as early as 1839 (Trowbridge, Shaw, and Schockel, 1916, p. 197), the ore was not mined commercially until the late 1850's when a smelter process capable of treating the zinc ore economically was developed. Once this process was perfected, zinc became the predominant metal produced from the Upper Mississippi Valley District.

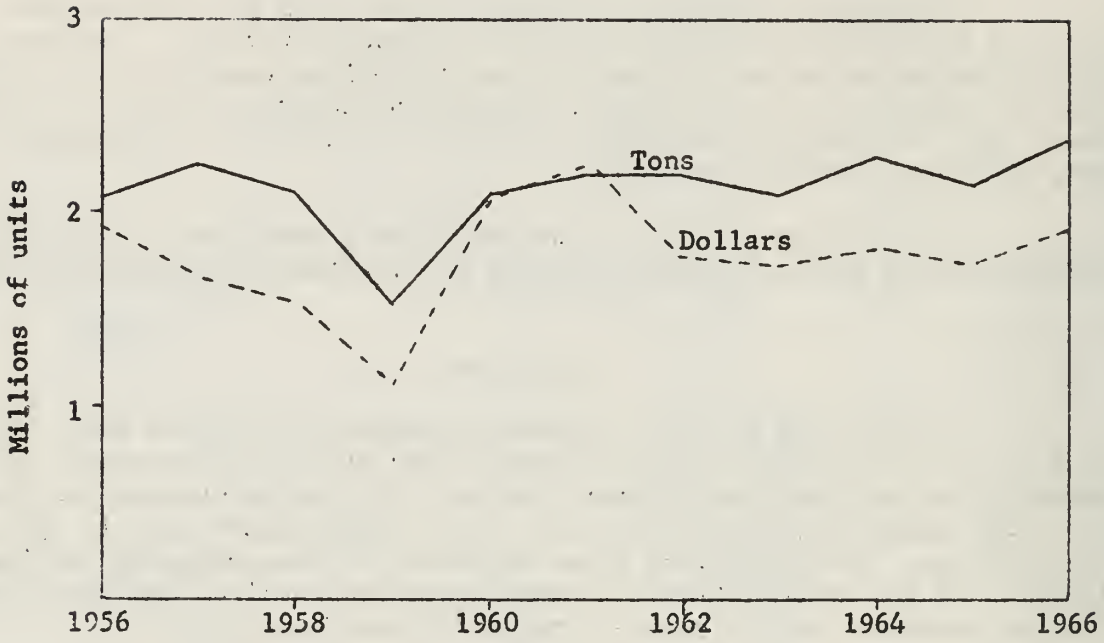

Fig. 6 - Production and value of sand in the Northwestern Illinois Region, 1956 to 1966.

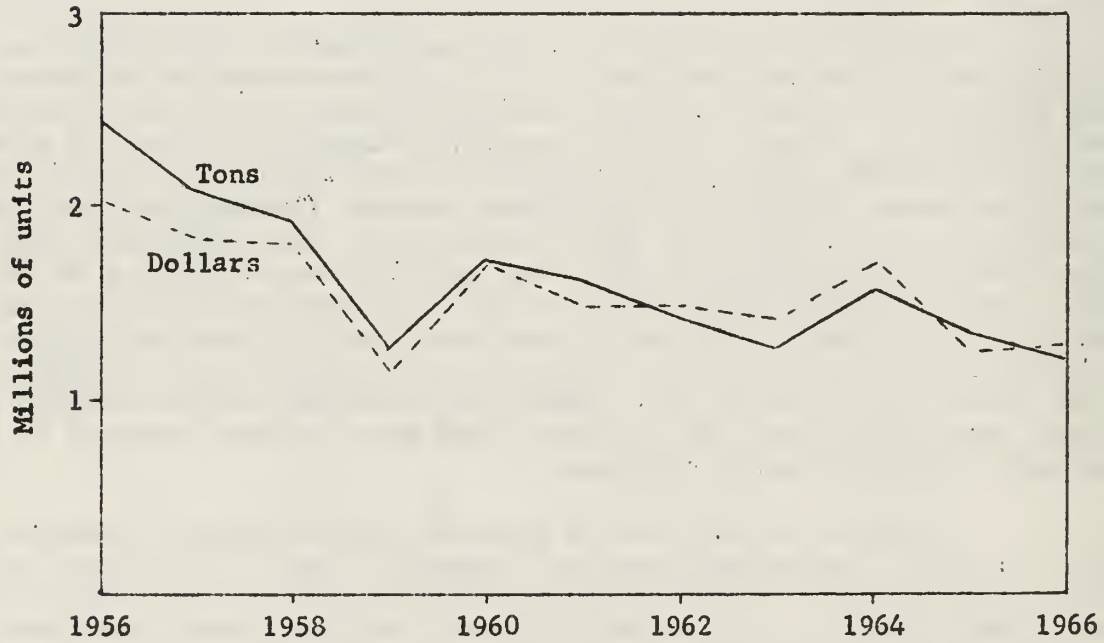

Fig. 7 - Production and value of gravel in the Northwestern Illinois Region, 1956 to 1966.

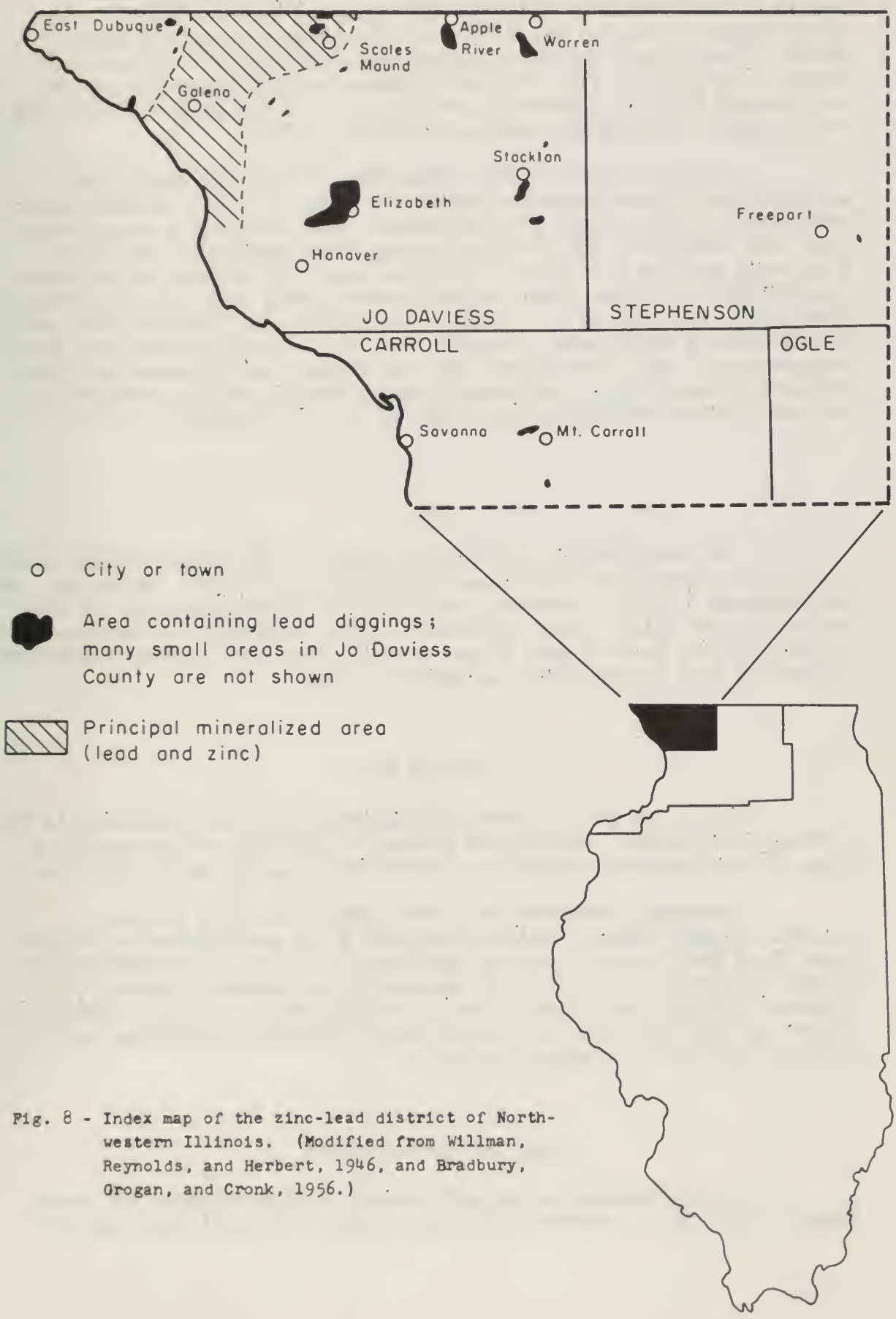

Fig. 8 - Index map of the zinc-lead district of Northwestern Illinois. (Modified from Willman, Reynolds, and Herbert, 1946, and Bradbury, Orogan, and Cronk, 1956.)

The geology, ore deposits, mines, prospects, and history of mining in this region of Illinois are discussed in some detail in the early Survey reports by Cox (1914) and Trowbridge, Shaw, and Schockel (1916). Geological aspects of prospecting and areas for prospecting in the zinc-lead district have been reported on by Willman, Reynolds, and Herbert (1946). A geologic structure map of the zinc-lead district was prepared by Bradbury, Grogan, and Cronk (1956).

Since the late 1800's, production of zinc and lead in the northwestern Illinois mining district has been on an intermittent basis, with annual tonnage varying considerably. Even in 1960, a recent peak year, the district's share of the national zinc production was under 5 percent, and for most years during the past half century it has been considerably less than that. At the present time, only the Eagle-Picher Company is still mining in the area. It operates a flotation mill north of the town of Galena that processes ore from several nearby mines into concentrates. The concentrates are then shipped out of state for final processing into metal. Individual company data cannot be revealed, but regional production has declined sharply in recent years.

COAL

The northernmost coal-bearing rocks of the Pennsylvanian System in Illinois extend into the southern parts of Rock Island, Whiteside, and Lee Counties (fig. 9). However, only in Rock Island County are minable coals known to exist. Cady and others (1952) estimated the reserves there at 62.1 million tons of coal in the ground. The last reported production of coal in Rock Island County occurred in 1948.

OIL AND GAS

No oil or gas in commercial quantity has been discovered in the Northwestern Illinois Region, but several petroleum products pipelines (fig. 10) and numerous natural gas pipelines (fig. 11) serve the area.

Recently, Commonwealth Edison Company (Central Illinois Electric and Gas Company Division) applied for a certificate of convenience from the Illinois Commerce Commission to build an underground gas storage project near the town of Pecatonica in Winnebago County. This proposed facility would have capacity to store some 3 billion cubic feet of gas, and the upper part of the Eau Claire Formation (Cambrian age) would be used as the storage reservoir.

CLAY AND CLAY PRODUCTS

Clay resources in the Northwestern Illinois Region are rather limited (fig. 12). Low-duty refractory clays of Pennsylvanian age are

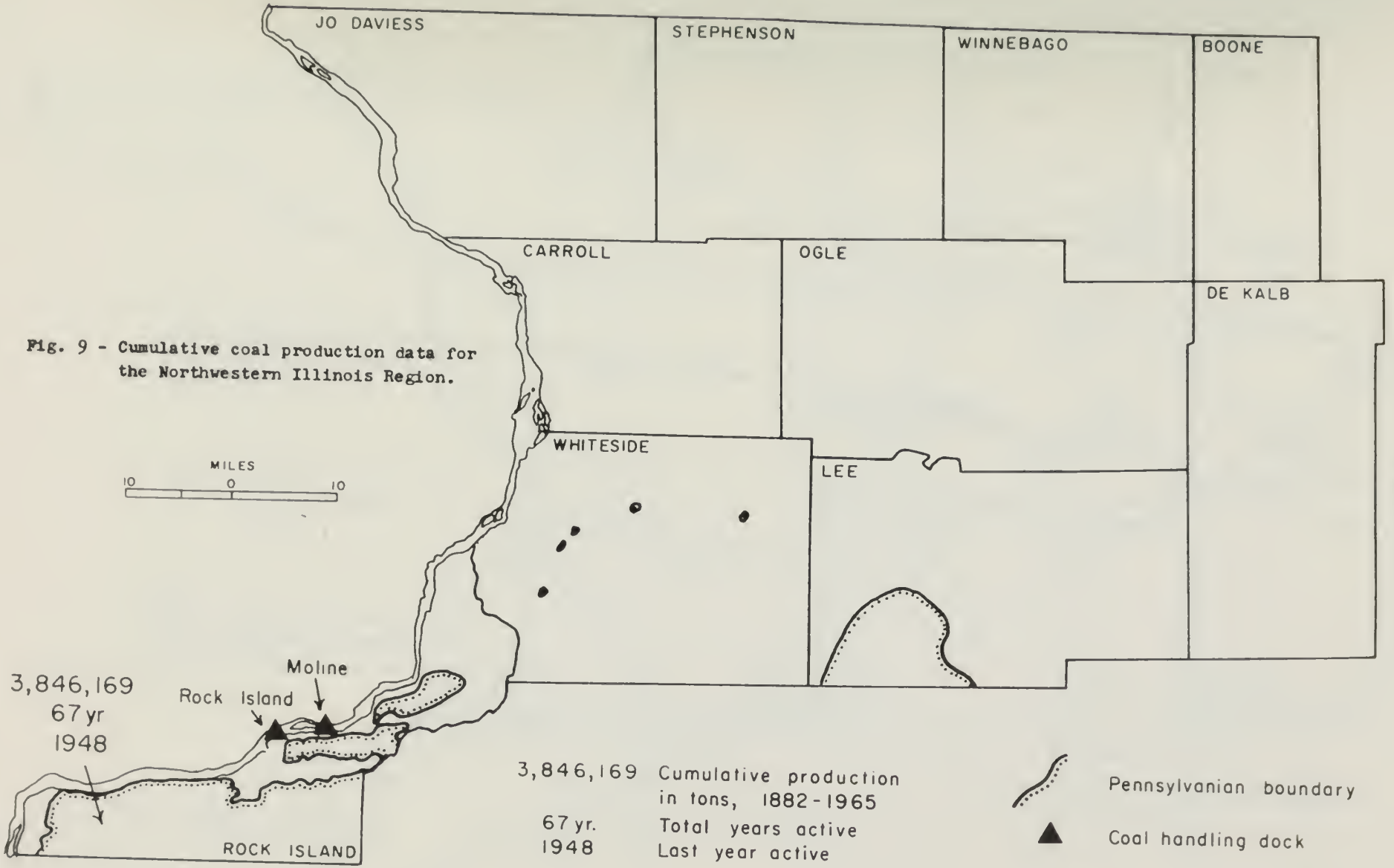

Fig. 9 - Cumulative coal production data for the Northwestern Illinois Region.

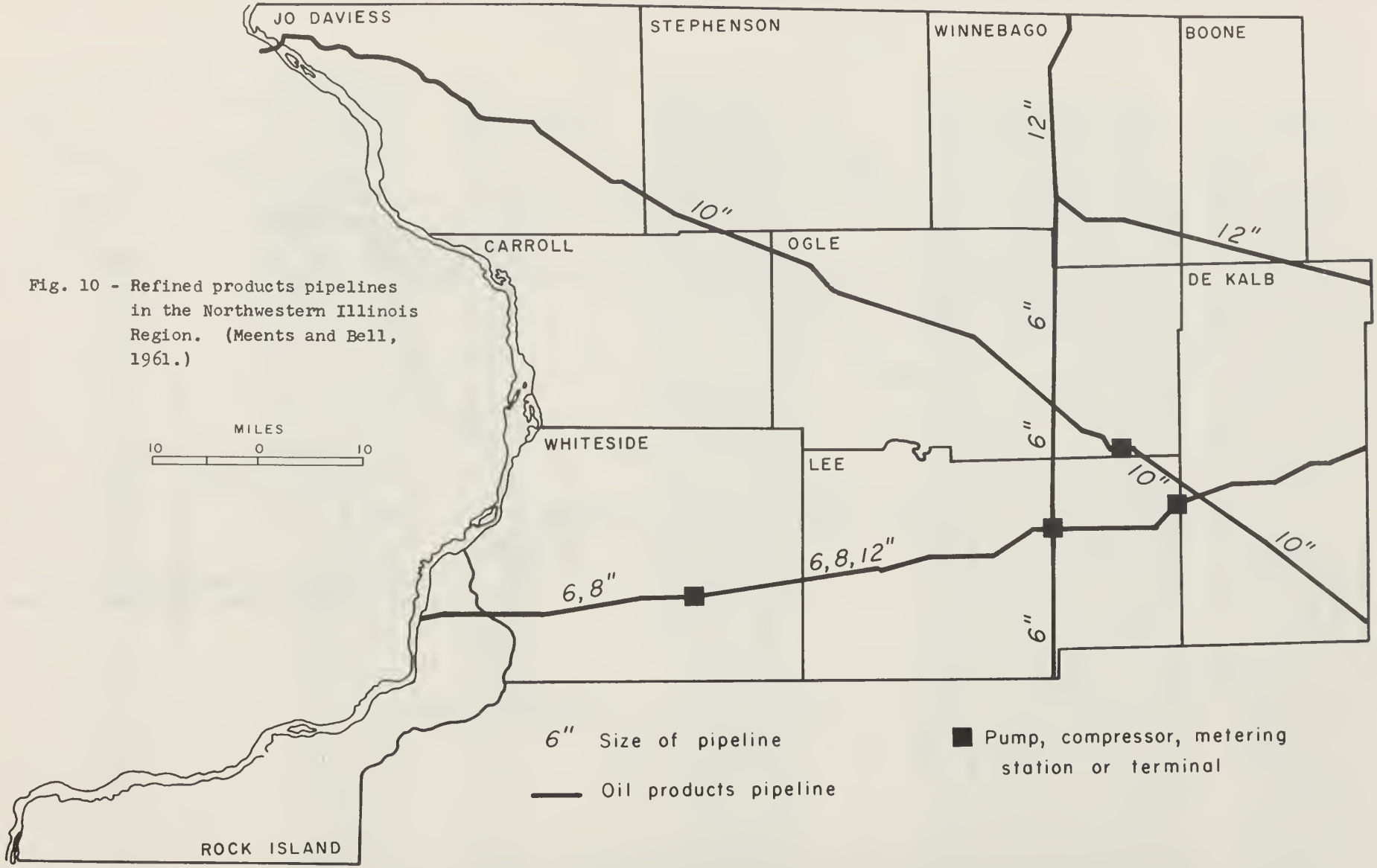

Fig. 10 - Refined products pipelines in the Northwestern Illinois Region. (Meents and Bell, 1961.)

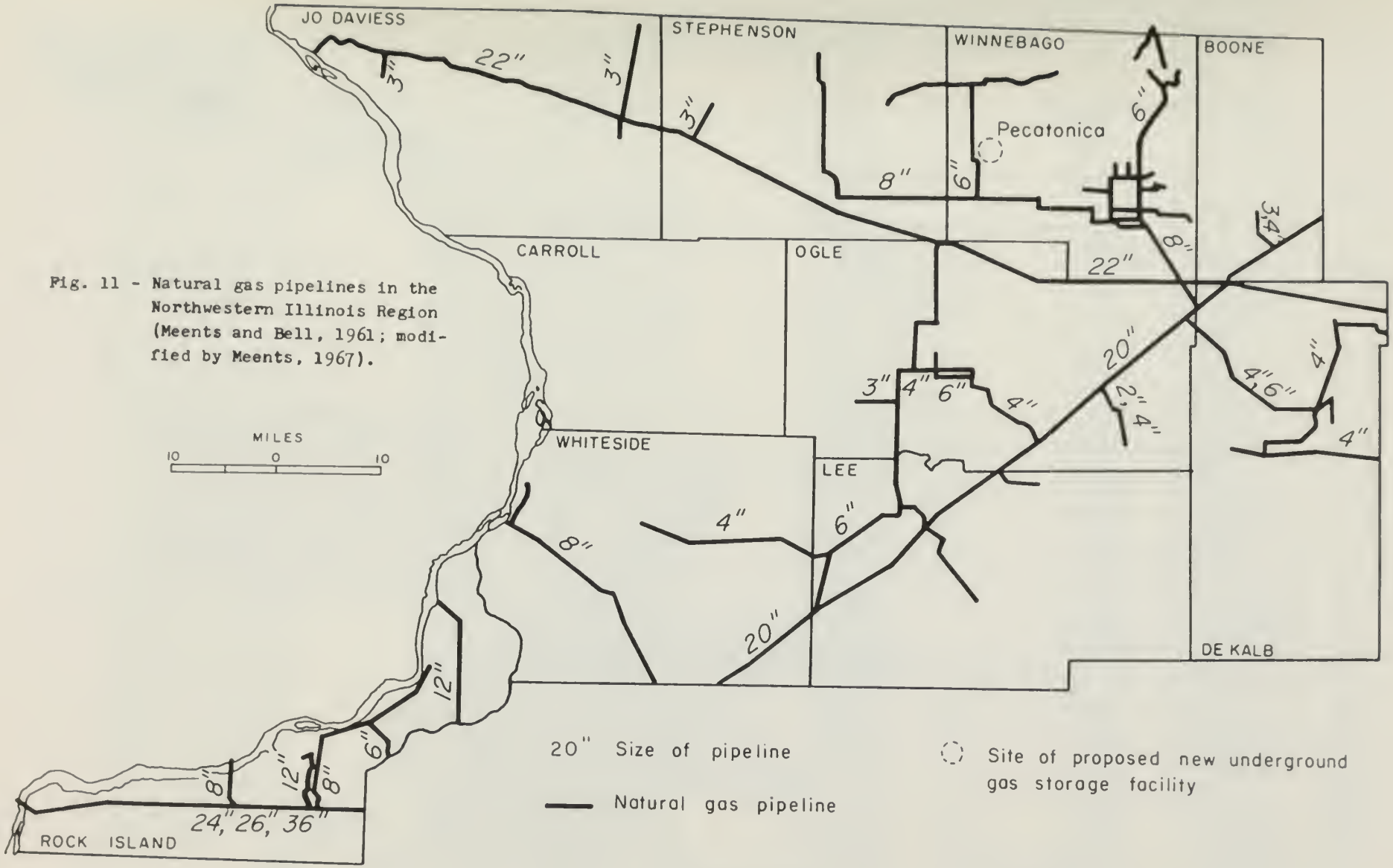

Fig. 11 - Natural gas pipelines in the Northwestern Illinois Region (Meents and Bell, 1961; modified by Meents, 1967).

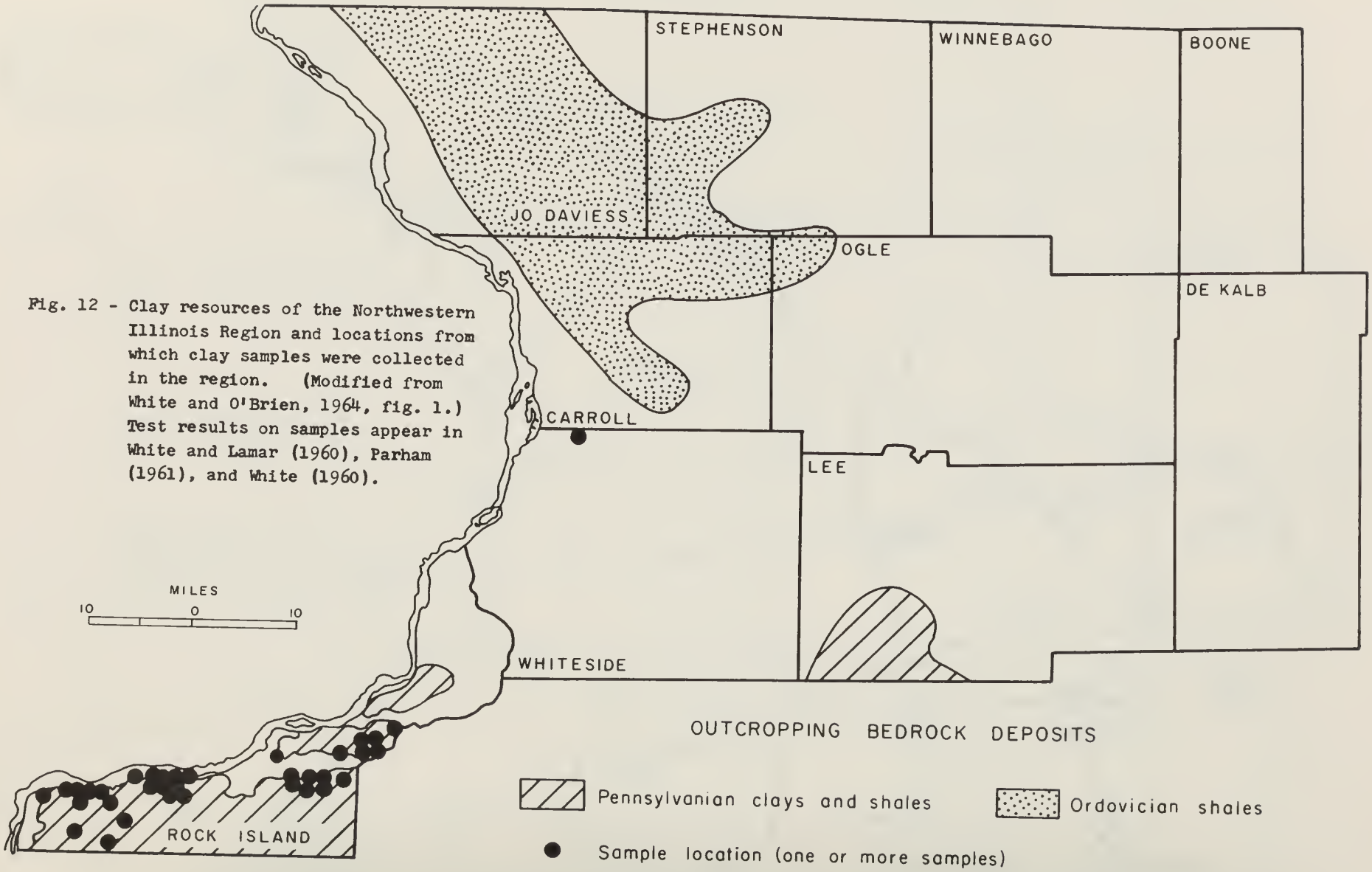

Fig. 12 - Clay resources of the Northwestern Illinois Region and locations from which clay samples were collected in the region. (Modified from White and O'Brien, 1964, fig. 1.) Test results on samples appear in White and Lamar (1960), Parham (1961), and White (1960).

fairly extensive in Rock Island County (fig. 13). In the northwestern corner of the region Ordovician shales occur, particularly in Jo Daviess County.

Testing of the clay and shale resources in the region has been restricted almost entirely to samples from southern Rock Island County. Test results were reported for three samples by White and Lamar (1960), for 62 samples by Parham (1961), and for one sample by White (1960). The most frequently mentioned suggested uses for these clays were as structural clay products, sewer pipe, drain tile, flower pots, and art pottery.

In the past, several small clay products plants have operated in the region, but the last one ceased operation in 1964. Because there are so few producers, no data on annual production in recent years can be published.

UNDEVELOPED MINERALS

Illinois possesses a number of mineral materials that, at present, are not being exploited. The low grade of the materials and/or the high cost of processing them have made their exploitation uneconomic in the past. A brief discussion of these resources and the problems associated with their use follows.

Oil Shale

As early as 1870 the presence of oil in certain shales in Illinois was reported by Worthen (1870). However, no comprehensive testing or evaluation of these shales was carried out until 1956. At that time, members of the staff of the Geological Survey collected and tested 114 shale samples from 41 counties (Lamar, Armon, and Simon, 1956). In addition, the highly organic Decorah Limestone of Jo Daviess County was tested. Although the oil yield from the limestone was quite low, samples of the natural residual concentrate of the organic material in the limestone, known as "oil-rock shale," were found to have a yield of over 30 gallons of oil per ton of shale. However, the available quantity of this shale is small. Figure 14 indicates the locations and yields of the tested samples.

Feldspar-Bearing Sands

Feldspar, an essential constituent in the manufacture of glass, pottery, and ceramics, is a mineral occurring in many Illinois sand deposits. In 1965 Illinois was the third largest consumer of ground feldspar in the United States, consuming 66,160 tons, all of which came from out-of-state because no feldspar was produced in Illinois (U. S. Bur. Mines, 1966, p. 396). At present, feldspar is imported from South Dakota and North Carolina, involving substantial freight charges. For this reason, it has been suggested that certain of the sands in Illinois

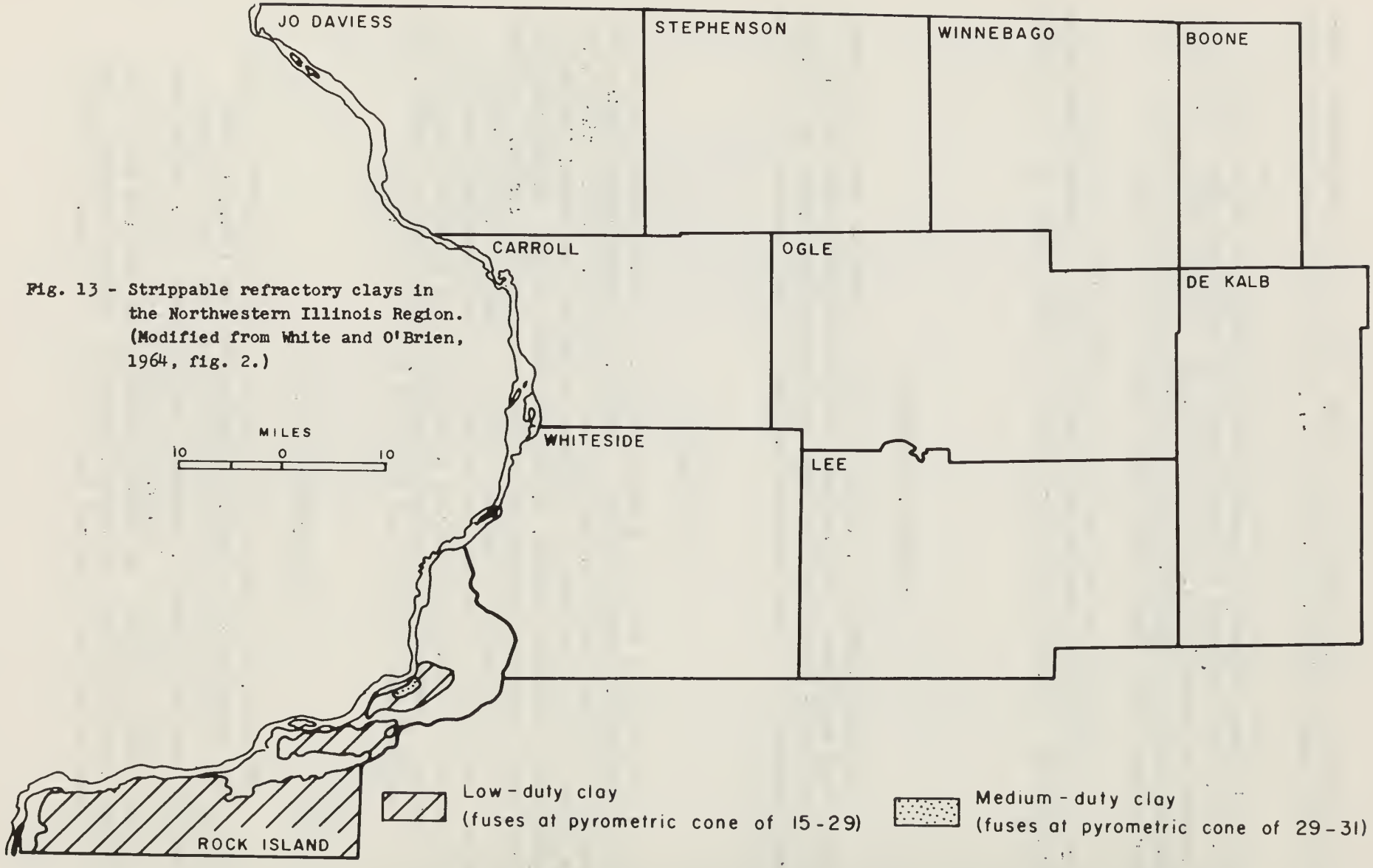

Fig. 13 - Strippable refractory clays in the Northwestern Illinois Region. (Modified from White and O'Brien, 1964, fig. 2.)

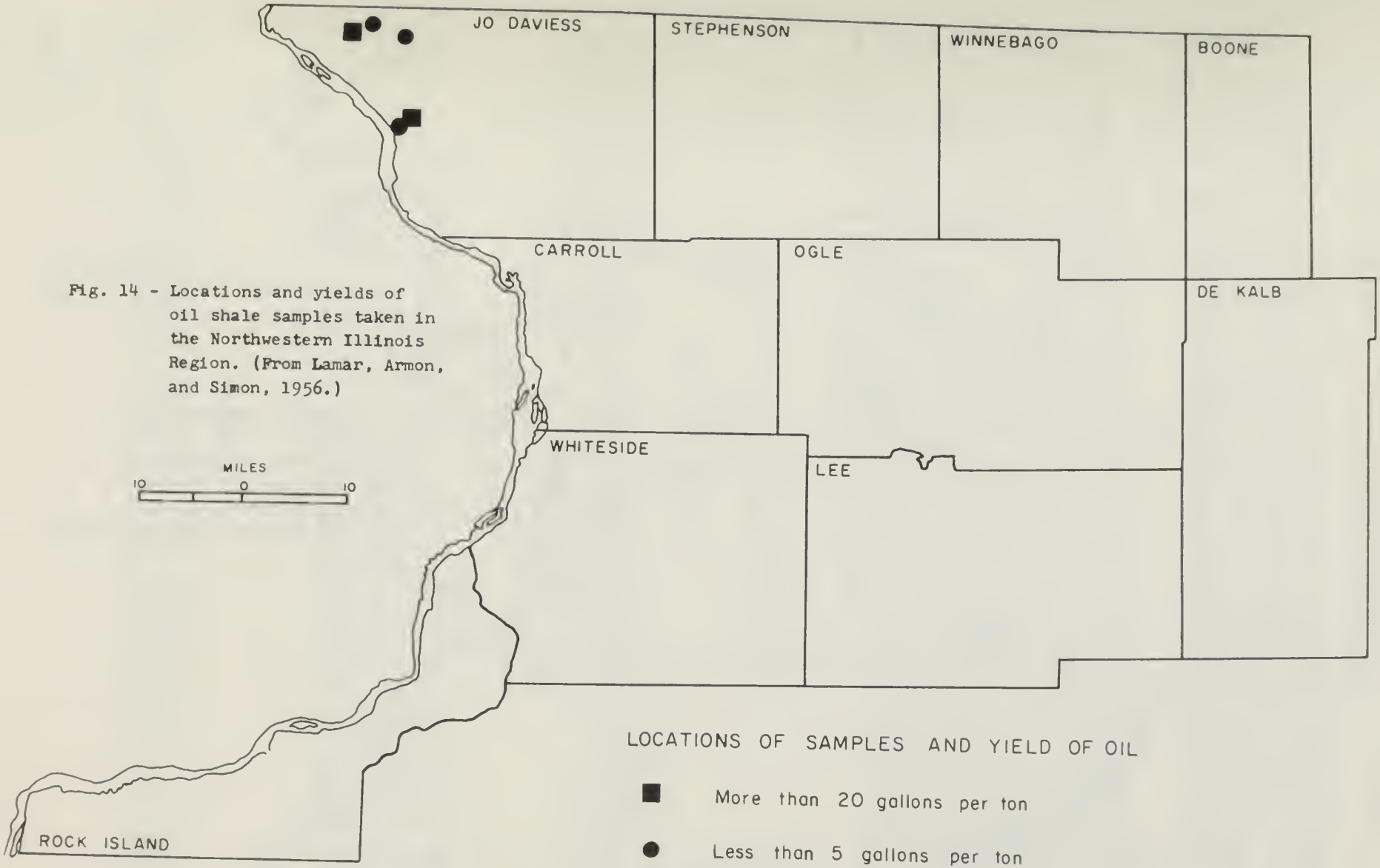

Fig. 14 - Locations and yields of oil shale samples taken in the Northwestern Illinois Region. (From Lamar, Armon, and Simon, 1956.)

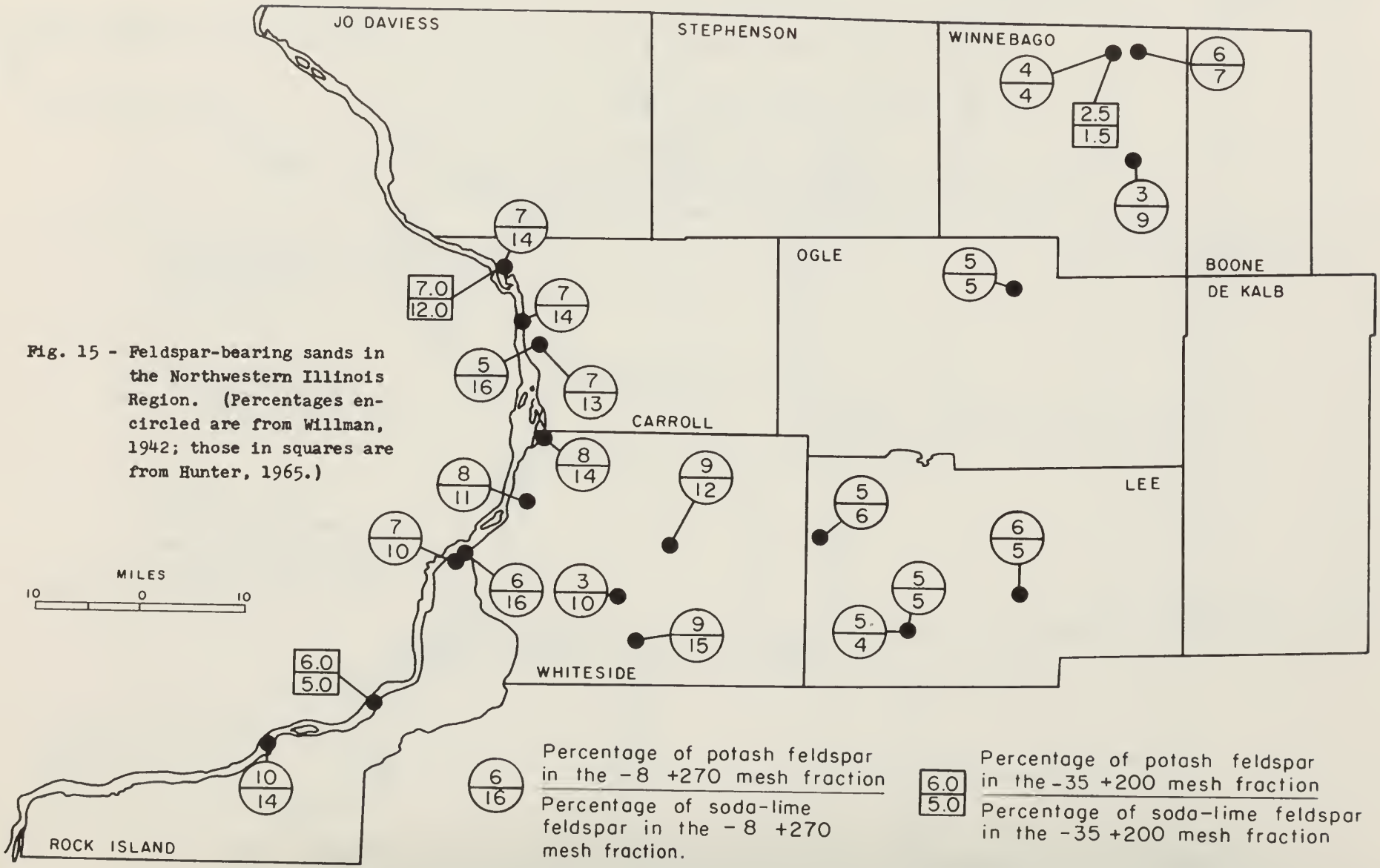

Fig. 15 - Feldspar-bearing sands in the Northwestern Illinois Region. (Percentages encircled are from Willman, 1942; those in squares are from Hunter, 1965.)

might be beneficiated to produce a feldspar concentrate of acceptable grade that could supply all or part of the state's needs.

The locations of sand samples tested by Willman (1942) and Hunter (1965) for feldspar content are shown in figure 15. Twenty samples of feldspar-bearing sands were collected by Willman. Hunter later restudied two of Willman's samples (48 and 64) plus an additional sample from near Hampton in Rock Island County. Testing revealed that the sands in the Savanna region along the Mississippi River had the highest feldspar content.

A key factor in the utilization of feldspar for ceramics and glass-making purposes is its iron oxide content. The maximum allowable for flint (clear) glass is 0.05 percent iron oxide (Fe_2O_3); for amber glass it is 0.50 percent (U. S. Bur. Mines, 1965, p. 322). Hunter (1965) studied the mode of occurrence and amount of iron oxide in the feldspars of his sand samples. He found that the sands contain potash feldspar, soda-lime feldspar, and feldspathic rock fragments, and the potash feldspar contains less iron oxide than either of the other two forms. When the feldspars were treated with acid in the laboratory, their iron oxide content was reduced to near commercial grade. Treated samples of potash feldspar contained from 0.10 to 0.31 percent iron oxide, whereas treated soda-lime feldspar had from 0.16 to 0.56 percent.

PROCESSING AND DISTRIBUTION FACILITIES

Introduction

The Northwestern Illinois Region possesses, in addition to primary mineral production facilities, various processing and distribution facilities related to the mineral industries of the region. The locations of these facilities are shown in figure 16.

Metals

Northwestern Steel and Wire Company operates five electric arc furnaces for the manufacture of carbon steel and four rolling mills (Amer. Iron and Steel Inst., 1964). The company's plant is located at Sterling in Whiteside County. The Eagle-Picher Company operates the Graham flotation mill north of Galena, Jo Daviess County, which primarily produces zinc concentrates plus smaller amounts of lead concentrate as a by-product (U. S. Bur. Mines, 1967, p. 290).

Nonmetallics

Crude perlite and vermiculite, mined out-of-state, are processed by Mica Pellets, Inc., at its plant in DeKalb, DeKalb County (U. S. Bur. Mines, 1967, p. 287, 289). The company produces an exfoliated vermiculite

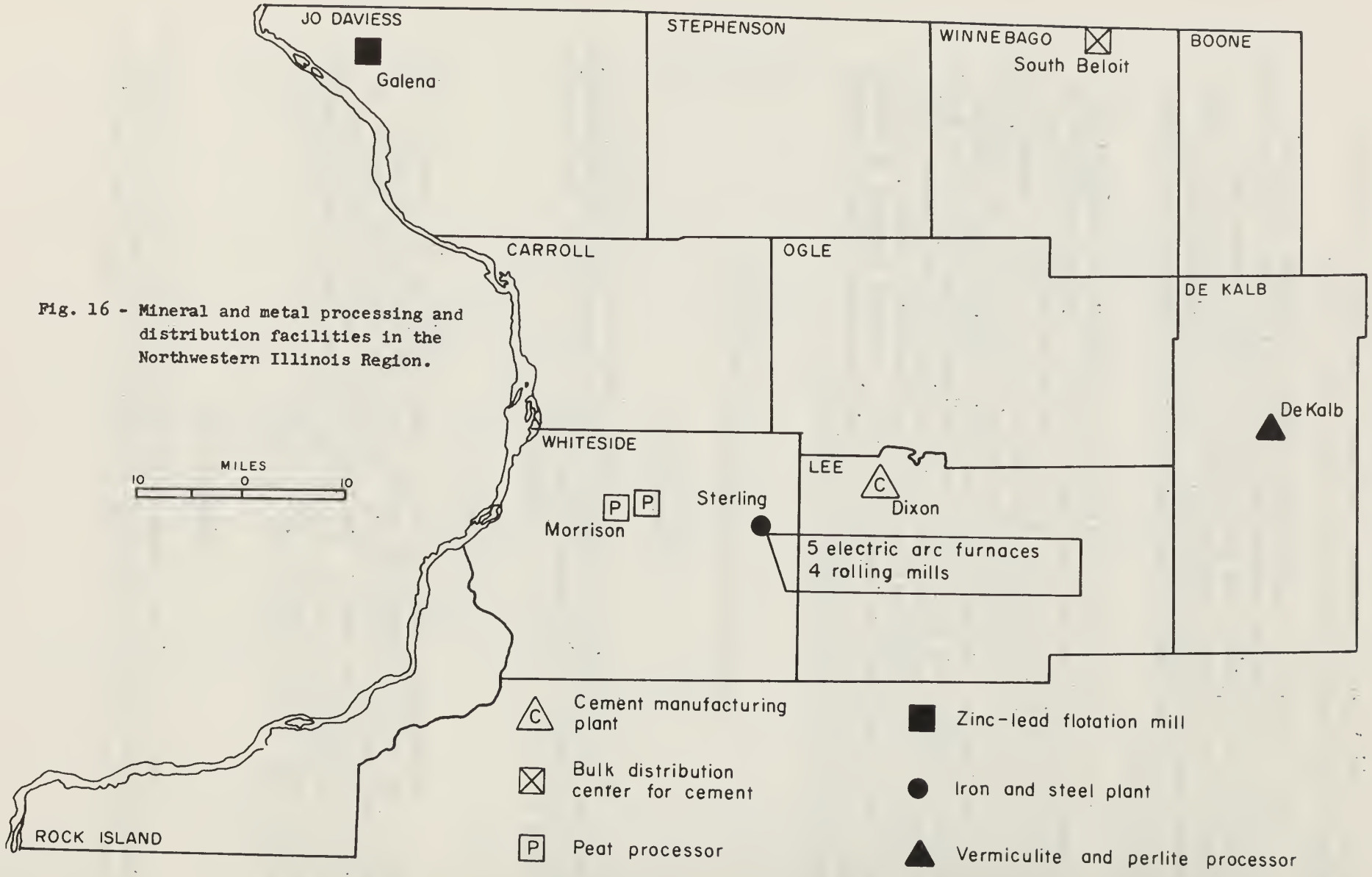

Fig. 16 - Mineral and metal processing and distribution facilities in the Northwestern Illinois Region.

for fill insulation for houses, plaster aggregate, concrete aggregate, masonry fill, and other miscellaneous uses. They also produce an expanded perlite for building plaster, loose-fill insulation, concrete aggregate, soil conditioning, and other miscellaneous purposes.

Whiteside County is one of four in Illinois that produce peat. Anderson Peat Company produces moss peat and Markman Peat Company produces reed-sedge peat at plants located near the town of Morrison (U. S. Bur. Mines, 1967, p. 302). The peat, sold both in bulk and packaged form, is used as a soil conditioner.

Medusa Portland Cement Company operates one of the four Illinois cement plants at Dixon in Lee County. This plant, using the dry process, has an annual capacity of 3.5 million barrels and produces both portland and masonry types of cement (Pit and Quarry, 1965). Lehigh Portland Cement Company operates a bulk distributing plant for cement in South Beloit (Winnebago County).

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